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Proceedings of the National Peer Review Meeting on Guidance Related to Bycatch and Discards in Canadian Commercial Fisheries

March 5-7, 2012
Montreal, Quebec

Chairpersons:
Jake Rice and Andrea White

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Compte rendu de la réunion d'examen par les pairs nationale sur les Orientations sur les prises accessoires et les rejets en mer des pêches commerciales canadiennes

Du 5 au 7 mars 2012
Montréal (Québec)

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Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings include research recommendations, uncertainties, and the rationale for decisions made by the meeting. Proceedings also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

Avant-propos

Le présent compte rendu a pour but de documenter les principales activités et discussions qui ont eu lieu au cours de la réunion. Il contient des recommandations sur les recherches à effectuer, traite des incertitudes et expose les motifs ayant mené à la prise de décisions pendant la réunion. En outre, il fait état de données, d'analyses ou d'interprétations passées en revue et rejetées pour des raisons scientifiques, en donnant la raison du rejet. Bien que les interprétations et les opinions contenues dans le présent rapport puissent être inexactes ou propres à induire en erreur, elles sont quand même reproduites aussi fidèlement que possible afin de refléter les échanges tenus au cours de la réunion. Ainsi, aucune partie de ce rapport ne doit être considérée en tant que reflet des conclusions de la réunion, à moins d'indication précise en ce sens. De plus, un examen ultérieur de la question pourrait entraîner des changements aux conclusions, notamment si l'information supplémentaire pertinente, non disponible au moment de la réunion, est fournie par la suite. Finalement, dans les rares cas où des opinions divergentes sont exprimées officiellement, celles-ci sont également consignées dans les annexes du compte rendu.

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SUMMARY

These proceedings summarize the relevant discussions and key conclusions that resulted from a Fisheries and Oceans Canada (DFO), Canadian Science Advisory Secretariat (CSAS) National Peer Review meeting of March 5 – 7, 2012, in Montreal, QC. Two working papers, focusing on determining mortality rates of bycatch species and discards and estimating the volume and diversity of Canadian bycatch discards, were presented for peer review.

Participation included DFO Science, DFO Program Policy, DFO Ecosystems and Fisheries Management, and external participation from environmental non-governmental organizations, and academia.

The conclusions and advice resulting from this review will be provided in the form of one Science Advisory Report providing advice to inform the development of a *Policy Framework on Managing Bycatch and Discards* under the DFO Sustainable Fisheries Framework and in management and policies related to the rational use of discards for aquaculture.

The Science Advisory Report and the two supporting Research Documents will be made publicly available on the CSAS Science Advisory Schedule at http://www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm.

SOMMAIRE

Le présent compte rendu résume les discussions pertinentes et conclusions principales découlant de la réunion d'examen national par les pairs du Secrétariat canadien de consultation scientifique (SCCS) de Pêches et Océans Canada (MPO) qui s'est tenue du 5 au 7 mars 2012, à Montréal (Québec). Deux documents de travail portant sur la détermination des taux de mortalité des espèces faisant l'objet de prises accessoires et les rejets en mer et l'estimation du volume et de la diversité des rejets en mer des captures accessoires au Canada ont été présentés aux fins d'examen par les pairs.

Les participants comprenaient du personnel du Secteur des sciences, du Secteur des Politiques relatives aux programmes, et du Secteur de la gestion des écosystèmes et des pêches du MPO. Des membres de l'extérieur provenant d'organisations non gouvernementales de l'environnement et du milieu universitaire ont également pris part à la réunion.

Les conclusions et avis découlant de cet examen seront présentés sous la forme d'un avis scientifique afin d'orienter l'élaboration d'un *Cadre de politique pour la gestion des prises accessoires et des rejets en mer*, en vertu du Cadre pour la pêche durable du MPO, et pour guider la gestion et les politiques liés à l'utilisation rationnelle des rejets à des fins aquacoles.

L'avis scientifique et les deux documents de recherche à l'appui seront rendus publics sur le calendrier des avis scientifiques du SCCS, à l'adresse http://www.dfo-mpo.gc.ca/csas-sccs/index-fra.htm.

INTRODUCTION

A Fisheries and Oceans Canada (DFO) Canadian Science Advisory Secretariat (CSAS), National Peer Review meeting was held on March 5 – 7, 2012, in Montreal, QC to provide advice that will inform the development of a *Policy Framework on Managing Bycatch and Discards* under the DFO Sustainable Fisheries Framework and in management and policies related to the rational use of discards for aquaculture.

The Terms of Reference (TOR) for this science review (Appendix A) were developed in response to a request for advice from DFO Program Policy. In addition to relevant participants from DFO, individuals with relevant expertise from industry, environmental non-governmental organizations, and academia were invited to attend this peer review.

The following working papers (WP) were prepared and made available to meeting participants prior to the meeting:

1. 'Critical review and analysis of existing risk-based techniques for determining sustainable mortality levels of bycatch species' (Sebastian Pardo, Nicholas Dulvy, and Andrew Cooper); and
2. 'The extent and diversity of the harvest fishery bycatch in Canadian commercial fisheries and the possible rational utilization for aquaculture feed production' (Mike Chadwick)

In addition, the following background papers were made available to meeting participants prior to the meeting:

1. 'A comparative analysis of marine fish species susceptibilities to discard mortality: effects of environmental factors, individual traits, and phylogeny' (Hugues Benoît, S. Plante, M. McGlauflin, and Thomas Hurlbut)
2. 'Assessing the factors influencing discard mortality of demersal fishes using a semi-quantitative indicator of survival potential' (Hugues Benoît, Thomas Hurlbut, and Joël Chassé; 2010)
3. 'Can the data from at-sea observer surveys be used to make general inferences about catch composition and discards?' (Hugues Benoît, and Jacques Allard; 2009)
4. 'Estimating fishery-scale rates of discard mortality using conditional reasoning.' (Hugues Benoît, Thomas Hurlbut, Joël Chassé, and Ian Jonsen; 2011)

MEETING OBJECTIVES

The primary objectives of the meeting were complex and are outlined in detail in the Terms of Reference for the meeting. In brief, the meeting objectives included identifying the key components of a science-based framework to establish safe biological limits for bycatch species; reviewing different approaches for assessing sustainability of fishing impacts; and determining which species would be appropriate for consideration in the production of fishmeal and fish oil for aquaculture.

WELCOME AND OPENING REMARKS

The meeting co-Chairs, Jake Rice and Andrea White, welcomed participants, reviewed the role of CSAS in the provision of peer reviewed advice, and gave a general overview of the CSAS process. The Chairs discussed the role of participants and the definition and process around

achieving consensus decisions and advice. Everyone was invited to participate fully in the discussion and to contribute knowledge to the process, with the goal of delivering scientifically defensible conclusions and advice.

The Chairs reviewed the Agenda (Appendix B) and noted that there would be some changes made to it through the meeting. In total, 26 people participated in the peer review meeting (Appendix C). Erika Thorleifson was identified as the Rapporteur for the meeting.

The conclusions and advice resulting from this review will be provided in the form of a Science Advisory Report to DFO Fisheries and Aboriginal Policy to inform the development of a *Policy Framework on Managing Bycatch and Discards* under the DFO Sustainable Fisheries Framework and in management and policies related to the rational use of discards for aquaculture. The Science Advisory Report and two supporting Research Documents will be made publicly available on the CSAS Science Advisory Schedule at http://www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm.

PRESENTATIONS AND DISCUSSIONS

PRESENTATION 1: Overview of International Commitments related to bycatch with particular focus on UNGA Resolutions, FAO Technical Guidelines, and CBD Targets

Presented by Jake Rice

Endorsed by Canada, the United Nations General Assembly (UNGA) approved *Resolution 64/72* on *Sustainable Fisheries* in September 2009. This Resolution calls on States and regional fisheries management organizations and arrangements (RFMO/A) to apply the precautionary and ecosystem approaches in adopting and implementing conservation and management measures to address bycatch, pollution, over-fishing, and to protect habitats of specific concern.

Coordinated by the Food and Agriculture Organization (FAO) Committee on Fisheries (COFI), the *International Guidelines on Bycatch Management and Reduction of Discards* were developed to assist States and RFMO/As in implementing the 'Code' and an ecosystem approach to fisheries through effective management of bycatch and reduction of discards. The FAO *Bycatch Guidelines* can be found at: http://www.fao.org/cofi/cofi2011/en/.

The FAO *Bycatch Guidelines* indicate that States should establish and implement national policies for the effective management of bycatch and reduction discards based on the application of the ecosystem approach to fisheries and should give consideration to all significant sources of fishing mortality. In addition to efforts to reduce bycatch, the *Guidelines* encourage efforts to ensure rational utilization is made of the remaining bycatch and discards that would otherwise be wasted. One possible option for the rational utilization of bycatch and discards may be the incorporation into the production of fishmeal and fish oil for the production of aquaculture feed.

Endorsed by Canada and similar to the guidance of the FAO, Aichi Biodiversity Target #6 of the *Convention on Biological Diversity* (CBD) is focused on the sustainable management and harvest of all fish and invertebrate stocks through the application of ecosystem-based approaches, including ensuring that the impacts of fisheries on stocks, species, and ecosystems are within safe ecological limits. The Aichi Targets of the CBD can be found at: http://www.cbd.int/sp/targets/.

In alignment with its international commitments, Canada is domestically implementing the Sustainable Fisheries Framework (SFF) which aims to ensure that fisheries are environmentally sustainable while supporting economic prosperity. A key component of the SFF is its *Policy Framework on Managing Bycatch and Discards* (currently under development). The draft *Policy* aims to ensure that Canadian fisheries are managed in a manner that supports the sustainable harvesting of aquatic species by:

- Minimising the risk of fisheries causing serious or irreversible harm to bycatch and discard species; and
- Accounting for total catch, including bycatch and discards.

PRESENTATION 2: Overview of DFO Bycatch Policy

Presented by Marc Clemens

The draft policy is national in scope and applies to all commercial, recreational and Aboriginal fisheries managed under the Fisheries Act, including aquaculture activities, regulated by Fisheries and Oceans Canada.

The draft Bycatch Policy applies to that portion of the retained catch for which the harvester was not licensed but he/she may or must retain. It also applies to all non-retained catch, including birds, marine mammals and sea turtles that become entangled in fishing gear. The Policy does not apply to any catch that harvesters are licensed to fish and that is retained, as the management of the retained, targeted catch is guided by the Precautionary Approach Policy Framework (Figure 1). This includes any catch that license holders are authorized to fish in catch-and-release fisheries. It also does not apply to corals and sponges, as conservation and management of these species is covered under the *Sensitive Benthic Areas Policy*.

The objectives of the policy are:

- to ensure that Canadian fisheries are managed in a manner that supports the sustainable harvesting of aquatic species and that minimizes the risk of fisheries causing serious or irreversible harm to bycatch species; and,
- to account for total catch, including retained and non-retained bycatch.

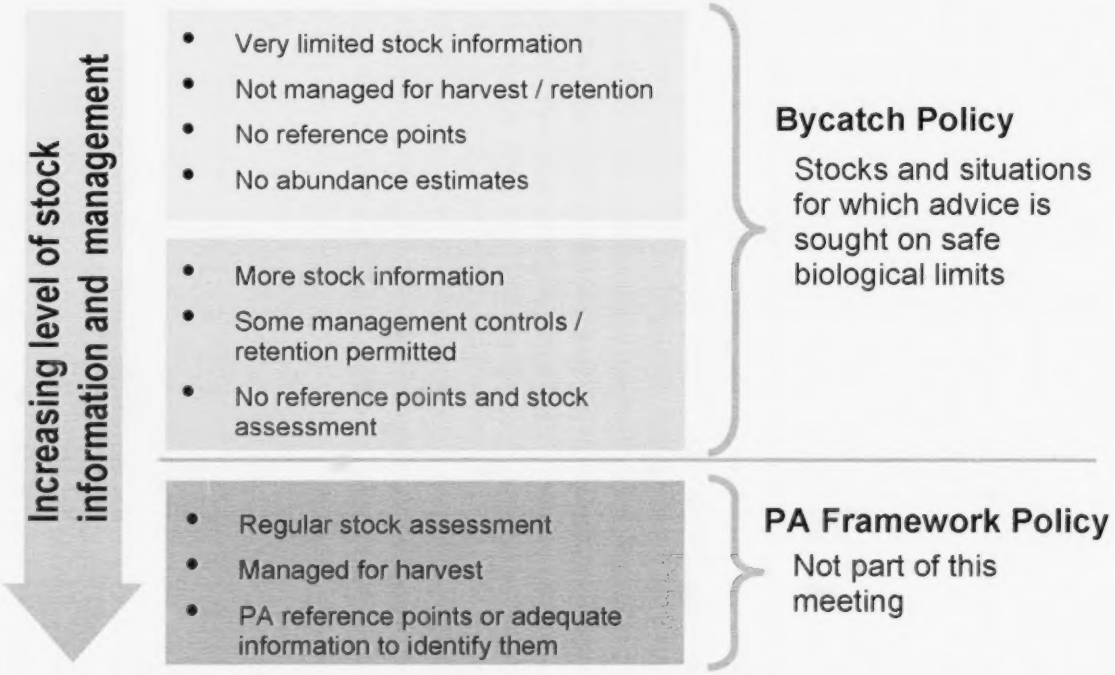
Increasing level of stock information and management
Very limited stock information
Not managed for harvest / retention
No reference points
No abundance estimates
More stock information
Some management controls / retention permitted
No reference points and stock assessment
Bycatch Policy
Stocks and situations for which advice is sought on safe biological limits
Regular stock assessment
Managed for harvest
PA reference points or adequate information to identify them
PA Framework Policy
Not part of this meeting

Figure 1. Data quantity for species under the Bycatch Policy and the Precautionary Approach Framework Policy

Discussion

- There was some discussion on what the enforcement measures that have been taken for fishing past a bycatch threshold or cap. Cusk and Atlantic Halibut were raised as examples of fisheries that have been closed because they reached the bycatch cap.
- There was a question on whether sea cucumbers would be covered under the *Sensitive Benthic Areas Policy*. Only corals and sponges are covered under that *Policy* at this time.

Discussion

- There was continued discussion on how the *Sensitive Benthic Area Policy* would be applied for bycatch. Currently the targets of the policy are corals and sponges although it could be expanded in the future
- The point was made that the focus of the Science-based Encounter Protocol Framework for Corals and Sponges meeting, March 15-18, 2011[1], was tow-by-tow guidance on how to protect an area that is considered to have important aggregations of corals and/or sponges. This meeting isn't providing that level of guidance, rather broader fisheries level guidance.

[1] DFO. 2011. Science-based encounter protocol framework for corals and sponges. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2011/048.

PRESENTATION 3: Estimating discard mortality rates and understanding the biological, technical and environmental factors that affect them

Presented by Hugues Benoit

Establishing the sustainability of fishing mortality for an incidentally captured organism requires determining the relative magnitudes of the species' productivity and fishing mortality. In turn, to estimate fishing mortality requires estimates of amounts caught, as well as the mortality rate resulting directly or indirectly from capture and release for discarded individuals. Obtaining a reliable (i.e., representative) estimate of discard mortality rate is a non-trivial and costly endeavor, and approaches were briefly reviewed. Ultimately, formal estimates will be likely possible for only a limited number of species and fisheries. However, an understanding of the factors affecting discard mortality can be gained simply and cost-effectively in existing sampling programs, as was shown based on the results of three recent studies. These key factors include:

- *Technical factors*, e.g., gear used and operation, handling practices, activity duration, catch amount;
- *Environmental factors*, e.g., temperature (bottom, surface, air), depth; and
- *Biological factors*, e.g., size, species traits (such as sedentariness, presence of swim bladder, deciduous scales).

Knowledge of the relationship between these factors and mortality can help inform a risk-based framework for evaluating the sustainability of discard mortality, including determining possible efficacy of management measures.

Discussion

- There were a couple questions about whether or not other factors and interactions were taken into account in the study. In response the presenter stated that they started to look at a few factors/interactions but the effects were confounded and it wasn't possible to disentangle them from each other. The study presented looked only at the technical and environmental (i.e. exposure to air) factors related to fish capture and how these factors affected bycatch mortality.
- There was a question about how many other studies that have been done like this? In response the presenter stated that the study on condition and validity has been done on the west coast of Canada for halibut – one study that was repeated for many years. He was also aware of this kind of experiment being conducted for a single species a number of times but was not aware of other studies with multi species.

PRESENTATION 4 (Working Paper 1): Critical review and analysis of existing risk-based techniques for determining sustainable mortality rates of bycatch species

Presented by Sebastian Pardo

The presentation provided an overview of the techniques available for the assessment of the status of bycatch species. For all the approaches discussed, data requirements, caveats, assumptions, recommendations, and comments on their accuracy and precision were provided, where available. First, the direct (i.e., based on catch data) methods were reviewed and then the indirect methods (i.e., based on meta-analytical models) for estimating natural mortality that are applicable to bycatch species were presented:

- Direct methods:
    - Catch curve analysis
    - Year class curve
- Indirect methods:
    - Size independent (average *M*)
    - Size dependent (*M* changes with size)

Second, the presentation described how natural mortality estimates and other demographic methods can be used to estimate sustainable fishing mortality rates and other reference points:

- Estimating sustainable mortality rates (from catch data)
    - Scalar approach
    - Natural mortality-based approach
    - Depletion-corrected average catch (DCAC)
    - Depletion-based stock reduction analysis (DB-SRA)
- Other frameworks for data-poor fisheries assessments
    - Productivity and susceptibility analysis (PSA)
    - Sustainability assessment for fishing effects (SAFE)
    - Ecological risk assessment for the effects of fishing (ERAEF)
    - Simpfendorfer *et al.* (2008) Ecological risk assessment (ERA)

Discussion

- There was a comment that the abundance of target species is not tied to bycatch abundance. Although in some cases bycatch species can be managed by increasing or decreasing fisheries quotas, it doesn't always and is not appropriate for bycatch.
- It was noted that historically, different models have been used on the east and west coasts of the United States.
- It was noted that the PSA is used as a screening tool but it could also be used as a risk-based management tool.
- A comment was made that survey areas cover larger areas than are fished and that commercial fishing focuses where fish are aggregated. Comparing data from scientific

surveys and from commercial fishing needs to take this into account. It was noted that the biology of the species helps to understand where the fish will aggregate.

- There was some discussion about ERAEF and it was noted that it is malleable and useful for documenting low risk items.
- There was also a general discussion around using age data:
    - Some fisheries don't have age data but growth parameters could be used as a substitute.
    - Age can be estimated indirectly
- It was noted that in general groundfish fisheries are data-rich compared to pelagic fisheries. However, pelagic species often make up the bulk of the bycatch biomass.
- There was a comment that there is a range of available data for different species from data-rich to almost no information, but where there is little known, expert knowledge often must fill the gap.
- One participant commented that when approaching a data-poor species there is often more information than there seems to be. It helps to start by indentifying real problems from non-problems and accepting that there will be continuous refining.
- There was a suggestion that if you're looking at a poorly studied stock from a species where there are some well studied stocks, it is possible to borrow the parameters from the well studied stocks. The borrowed parameters have been shown to be better than the limited data for that stock.

PRESENTATION 5: Potential biases inherent in using data from at-sea observer surveys to infer catch characteristics for a fishery

Presented by Hughes Benoit

At-sea observation is a key monitoring approach for the reliable quantification of discarded organisms. In many instances, this monitoring will be undertaken by at-sea observers. When coverage of fishing trips by observers is less than 100%, fishery-scale levels of discards must be inferred from sampled trips. Such inference is predicated on the assumption that observed and unobserved trips are statistically exchangeable. There are two principal reasons why this may not be so: a deployment effect resulting from non-random distribution of observers among sampling units, and an observer effect due to changes in fishing practice or location when observers are present. Analyses of data from a number of fisheries in the Gulf of St. Lawrence confirm the prevalence of deployment and observer effects. Both effects can impact the precision and accuracy of fishery-level inferences drawn from observer data, though the magnitude of the impacts and the direction of the bias cannot be estimated reliably. We are therefore presently unable to correct *post hoc* the data collected at-sea observer to account for these effects, and consequently modifications to observer program structure would be required to address them.

Discussion

- There was discussion about the use of cameras in Atlantic Canada. Cameras are used successfully in the Pacific but have not been adopted in Atlantic Canada. In the Pacific there were a number of factors that led to their implementation and once the cameras were in use they were appreciated and are cheaper over time compared to having

onboard observers. The standard is a review rate of 10%; if there is poor correspondence the review rate goes up.

- There was a comment that European Union is debating a full discard ban. If the EU proceeds with this then there will be considerable investment in the technology which would likely make it less expensive and possibly more attractive to the commercial fishing industry.
- There have been changes to the Canadian observer program over time. One participant noted that observer coverage has declined as industry has been required to pay for more of it. Another participant noted that the fleet structure has changed and the size of the vessel has shifted to smaller ones. This makes the observer program more expensive for industry.

PRESENTATION 6 (Working Paper 2): Estimating the volume and diversity of bycatch and discards from Canadian commercial fisheries

Presented by Mike Chadwick

The potential to use bycatch and discards as a source of feed for the Canadian aquaculture industry was examined in two steps. The first step estimated the weight of bycatch and discards in the 2009-2010 fisheries by directed species, location, gear type and season using logbook data archived in DFO's Zonal Interchange File Format database, from data sources on groundfish, shellfish and Pacific salmon in DFO Pacific Region and from published scientific analyses of observer data. There were many gaps in the literature, very few of the studies were completed during 2009-10 and there were very few analyses of bycatch and discards in gillnets, purse seines, longlines and pot fisheries. Despite these gaps, the major source of discards appeared to be the dredge fisheries for scallop and surfclam, shrimp trawls, groundfish trawls and large pelagic longlines. The lowest and most reliable estimate of discards was 38,000t, which was about 4% of total landings. The high estimate of 96,000 t represented about 10% of total landings. The second step examined the potential for utilizing the discarded material, a mixture of groundfish, crustaceans, mollusks and echinoderms, as an ingredient in aquafeeds. Currently, aquafeed components are created almost entirely from small pelagic fish taken from global stocks that are generally fully exploited. Discards could be used as a future source of fishmeal and fish oil but first it would be necessary to develop methods to collect and store the material that is likely landed at many widely dispersed ports. In the meantime, fishmeal and fish oil could be obtained from the large amount of waste in seafood processing, which is about 400,000t, tenfold the weight of discards from capture fisheries.

Discussion

- A comment: there is some bias by using worldwide numbers because the shrimp discards would be different because different regulatory regimes would have discard practices. The numbers in the working paper and presentation may be too high because of that bias.
- One participant felt that the invertebrate discards would not be very useful. They would not produce a viable amount of oil and that the exoskeleton would not provide any meal.
- A few participants noted information gaps in this work with respect to Canadian bycatch/discard data. The Chairs instructed participants to forward any relevant information to Mike Chadwick to add to the working paper.

DISCUSSIONS RELATED TO MEETING OBJECTIVES

Once the presentations were finished, the workshop participants broke out into two groups to work on the two primary tasks of the first part of the meeting: 1) the documentation of the composition and magnitude of bycatch in Canadian commercial fisheries; and 2) the evaluation of available methods to calculate natural mortality rates and sustainable mortality rates of bycatch species. The last day of the meeting focused on the potential use of discards for fishmeal and fish oil for aquaculture purposes.

The consensus advice formed from the meeting discussions can be found in the science advisory report. In coming to consensus on the SAR there were a few key topics that generated the majority of the discussion which are provided in detail below.

ISSUES WITH BYCATCH MONITORING

The importance of having reliable bycatch data was discussed throughout the meeting. Some of the particular issues were:

- Reliable monitoring of fisheries is the foundation for the draft *Bycatch Policy* and other fishery management and policy decisions.
- Positive bycatch records may not be reliable if there is an incentive (e.g. undesirable management actions if non-target species are caught) to misreport bycatch species. A lack of record of any given species does not necessarily mean that none were caught – it may only mean that it wasn't written down.
- There was extensive discussion on the different types of monitoring programs used in Canada and it was noted that there are significant differences across the country and between fisheries. Western Canada has the highest reported discards by weight and it has a more comprehensive monitoring program compared to Canadian east coast fisheries.
- Monitoring programs vary substantially in quality and reliability depending on the fishery. It may be a challenge to measure the efficacy of the *Policy* and to validate the data. This is an important piece to the success of the *Bycatch Policy* but it was agreed that it is beyond the scope of this meeting to discuss this issue further.
- An ideal situation would involve complete observation and perhaps mandatory landing of all bycatch. However, there are downfalls associated with mandatory landings such as the requirement to maintain individuals that would have likely survived as discards and also the economic cost to the industry.

QUALITY OF DATA

One point of discussion that was revisited a number of times during the meeting was the reality of the quantity and quality of data. These key points were:

- Estimates for bycatch will be done with the best data available but they will rarely be as good as the best data available for the species being harvested.
- There is no best way to determine benchmarks. It is best to use multiple methods and use the uncertainty among them for the most precautionary management. There is variability in the data and many of the methods discussed have not been used for the purpose long enough to fully understand their relative strengths and weaknesses.

- There are challenges in tracking rare bycatch species or bycatch that is caught in very small numbers. With small numbers, it will be difficult to know whether an increase or decrease in bycatch of that species is a matter of concern.
- The recent history of the bycatch, whether it's increasing, decreasing or staying the same, helps with interpretation of the models even if it's only anecdotal.

CONSERVATION CONCERNS

Ensuring that fisheries were not detrimental to a species survival was another topic that was discussed through the meeting. Points made were:

- Bycatch that are taken very rarely. If a species is rare but is very locally distributed it will be difficult to estimate its abundance. There may be a need to focus on managing the bycatch in that limited area. For widespread and rare species, an occasional one or two may need to be tolerated but if there is a spike in bycatch for a period of time then it should be managed. If the species is rare and it is being caught more often, this may be a cause for concern. At that point there may need to be some targeted work done on it to determine the impact the fishery may be having on the species.
- It is important to take a full account of total fish mortality through direct fisheries (including Aboriginal and recreational) and through bycatch. Improved monitoring of all sources of anthropogenic mortality would be ideal. One suggestion was to connect this information through geo-referencing or to particular ecosystems.
- The development of species caught as bycatch being promoted to a directed fishery through the *Bycatch Policy* was discussed. This is likely only to happen in cases where there is already a market for that bycatch and not solely because of the *Bycatch Policy*.
- Much of the discussion focused on finfish; however, throughout the meeting participants were reminded to consider other bycatch such as marine mammals, birds, sharks and turtles. For these species especially, on deck and discard handling plays a significant role in their post-release survival.
- Gear type and general fishery practices also play an important role in the level of bycatch and on the damage to the discards; however this topic was not part of the advice for this meeting.

BYCATCH FOR USE IN AQUACULTURE

There are some properties of bycatch that could make discards more usable for the aquaculture industry (e.g. fishmeal and fish oil):

- It is desirable to have the catch as fresh as possible for processing. Proximity to processing plants is an important consideration given the cost of transport and storage room for bycatch compared to the more valuable target species. As such, opportunities are higher where there are concentrations of landings.
- Maximizing value is important. For example, which species are currently being used as bait and which are used in the agriculture industry for fertilizer? Impacts of re-directing discards for aquaculture purposes on these other uses should be considered before looking at the potential of aquaculture feed.
- The nature of the bycatch is important. Under-utilized fish could be used for fish oil and fishmeal. However, if the bycatch is mostly invertebrates it will not be as usable as fish species.

- Regulatory discards should be returned to the sea for conservation purposes. The question is whether they could or should be used if they are not expected to survive. However, it is important that this advice does not encourage increased targeting of these species and regulatory bycatch would need to be well justified.
- In some areas the discards may create too much oxygen loss and become an ecosystem issue.

TERMINOLOGY

As expected when crafting advice, there were discussions on language and wording. These are some of the main points:

- There was a decision to use the term 'benchmark' instead of 'reference point' to avoid confusion with other uses of the term reference point in other DFO contexts (e.g. the Precautionary Approach).
- The definition of 'sustainable' was debated and it was concluded that it was best to use the definition in the *Bycatch Policy* if there is one.
- There was some consideration involved in the wording around the socio-economic aspects of the *Sustainable Fisheries Framework* and its *Bycatch Policy*. The *Policy* covers socio-economics and the science advisory report needs to be consistent with the *Policy*. However, it is not appropriate to discuss the socio-economic aspects of bycatch management at this advisory meeting. For example, there are no directed fisheries for seabirds, cetaceans, turtles, and other charismatic species but socio-economic considerations would have aim to have low rates of bycatch for these species.

SUMMARY AND CLOSING

The meeting concluded on time. The majority of the Science Advisory Report was completed and the Chairs stated their intention to circulate a draft within two weeks. Both working papers were approved as Research Documents. The Chair thanked the participants and the presenters.

REFERENCES CITED

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Simpfendorfer, C., Cortés, E., Heupel, M., Brooks, E., Babcock, E., Baum, J., McAuley, R., Dudley, S., Stevens, J.D., Fordham, S., and Soldo, A. 2008. An integrated approach to determining the risk of overexploitation for data-poor pelagic Atlantic sharks. ICCAT SCRS/2008/140

APPENDIX A: Terms of Reference

Guidance related to Bycatch and Discards in Canadian Commercial Fisheries

National Peer Review Meeting – National Capital Region

March 5-7, 2012
Montréal, QC

Co-Chairs: Jake Rice & Andrea White

Context

Endorsed by Canada, the United Nations General Assembly (UNGA) approved *Resolution 64/72* on *Sustainable Fisheries* in September 2009. This Resolution calls on States and regional fisheries management organisations and arrangements (RFMO/A) to apply the precautionary and ecosystem approaches in adopting and implementing conservation and management measures to address bycatch, pollution, over-fishing, and to protect habitats of specific concern.

Coordinated by the FAO Committee on Fisheries (COFI), the *International Guidelines on Bycatch Management and Reduction of Discards* were developed to assist States and RFMO/As in implementing the 'Code' and an ecosystem approach to fisheries through effective management of bycatch and reduction of discards. The FAO *Bycatch Guidelines* can be found at: http://www.fao.org/cofi/cofi2011/en/.

The FAO *Bycatch Guidelines* indicate that States should establish and implement national policies for the effective management of bycatch and reduction discards based on the application of the ecosystem approach to fisheries and should give consideration to all significant sources of fishing mortality. In addition to efforts to reduce bycatch, the *Guidelines* encourage efforts to ensure rational utilization is made of the remaining bycatch and discards that would otherwise be wasted. One possible option for the rational utilization of bycatch and discards may be the incorporation into the production of fishmeal and fish oil for the production of aquaculture feed.

Endorsed by Canada and similar to the guidance of the FAO, Aichi Biodiversity Target #6 of the *Convention on Biological Diversity* (CBD) is focused on the sustainable management and harvest of all fish and invertebrate stocks through the application of ecosystem-based approaches, including ensuring that the impacts of fisheries on stocks, species, and ecosystems are within safe ecological limits. The Aichi Targets of the CBD can be found at:http://www.cbd.int/sp/targets/.

In alignment with its international commitments, Canada is domestically implementing the Sustainable Fisheries Framework (SFF) which aims to ensure that fisheries are environmentally sustainable while supporting economic prosperity. A key component of the SFF is its *Policy Framework on Managing Bycatch and Discards* (currently under development). The draft Policy aims to ensure that Canadian fisheries are managed in a manner that supports the sustainable harvesting of aquatic species by:

- Minimising the risk of fisheries causing serious or irreversible harm to bycatch and discard species; and
- Accounting for total catch, including bycatch and discards.

The draft Policy applies to retained and discarded bycatch. It describes these categories as:

a. Any retained species or specimens that the fisher was not licensed to direct for but is required or permitted to retain;
b. All discards, including catch released from gear and entanglements, whether alive, injured or dead, and whether of the target species or the non-target species.

For some bycatch species there may already be sufficient information to assess stock status or to develop precautionary reference points, while others are managed through existing fishing plans. However for some bycatch species, there may be limited information on their biology, distribution, or status, and/or a lack of formal abundance estimates that result in a lesser understanding about how much bycatch mortality is occurring or whether these levels are sustainable.

A national Canadian Science Advisory Secretariat (CSAS) peer review process will be held in Montreal, Québec from March 5-7, 2012 to:

a. Provide science advice on the range of risk-based techniques available for determining sustainable mortality levels of Canadian bycatch species; and
b. Determine the total volume and diversity of bycatch and discards from Canadian commercial fisheries and identify those that could be used in the production of fishmeal and/or fish oil for aquaculture.

Objectives

Based on the working papers presented at the meeting, meeting participants will intend to fulfill the following objectives:

1. Considering all available relevant literature, discuss and determine the key components of a science-based framework to establish safe biological limits for bycatch species (e.g. identification of species likely to be captured, assess availability and levels of catch data; summary of available information and life history characteristics, evaluation of survivorship if released; maximum sustainable mortality rates, calculation of bycatch limits and unsustainable take, etc.).

2. Many approaches for assessing sustainability of fishing impacts on populations focus on the sustainability of the mortality rate. In that context:
    a. Review various techniques/approaches that could be used to determine natural mortality rates and maximum sustainable mortality rates of bycatch species;
    b. Review various techniques/approaches for converting maximum sustainable mortality rates into safe biological limits for bycatch species.
    c. For 2a) and 2b) report on the factors that would affect the accuracy and precision of the estimates of mortality rates, etc.
3. For any other techniques/approaches for assessing sustainability of bycatch that emerges from the literature review and discussions, outline the steps needed to determine safe biological limits and the key factors that would affect their suitability.

4. Considering all available, relevant information, estimate the volume and diversity of bycatch and discards from Canadian commercial fisheries.

5. Based on the information compiled in Objective 4), determine which species would be appropriate for consideration in the production of fishmeal and fish oil for aquaculture.

Note that science advice regarding the actual values of maximum sustainable mortality rates for bycatch species within Canadian waters will not be given at this peer review process. However,

in demonstrating how a certain technique may be used to estimate these limits, quantitative values may be given as examples.

Expected Publications

- Science Advisory Report
- Research Document(s)
- Proceedings

Participation

- DFO Science and other sectors of the Department
- fishing industry
- academia
- environmental non-governmental organizations

APPENDIX B: Agenda

Guidance related to Bycatch and Discards in Canadian Commercial Fisheries

March 5-7, 2012
Saint Laurent Room, Intercontinental Hotel, Montréal

Co-Chairs: Jake Rice and Andrea White

Monday, March 5, 2012

9:30	Opening Remarks and Introductions *(J. Rice & A. White; DFO)*
9:45	Overview of International Commitments related to bycatch with particular focus on UNGA Resolutions, FAO Technical Guidelines, and CBD Targets (Presentation by *J. Rice*)
10:00	Overview of DFO Bycatch Policy *(Presentation by M. Clemens; DFO)*
10:30	*Health Break*
10:45	Key components of a science-based framework to establish safe biological limits for bycatch and discard species (Objective #1) (*Break-out Groups* and *Discussion led by J. Rice & A. White)*
12:30	*Lunch (not provided)*
13:30	Key components of a science-based framework to establish safe biological limits for bycatch and discard species (Objective #1) – continued... *(Discussion led by J. Rice & A. White)*
15:00	*Health Break*
15:15	Critical review and analysis of existing risk-based techniques for determining sustainable mortality rates of bycatch species. *(Presentation by Sebastian Pardo; Simon Fraser University)*
16:30	Relevant outcomes from the Precautionary Approach Workshop (Feb. 2012) *(Presentation by J. Rice)*
16:45	Discard mortality considerations. *(Presentation by Hugues Benoît; DFO)*
17:45	Adjournment of Day 1

Tuesday, March 6, 2012

9:00	Recap of Day 1 and Overview of Day 2 *(J. Rice & A. White)*
9:15	Issues concerning the reliability of estimating discards using observer data. *(Presentation by H. Benoît)*
9:45	Determining natural mortality rates and maximum sustainable mortality rates of bycatch species (Objectives 2a, 2c, and 3) *(Discussion led by J. Rice & A. White)*
12:30	*Lunch (not provided)*
13:30	Converting maximum sustainable mortality rates into safe biological limits (Objectives 2b, 2c, and 3) – continued... *(Discussion led by J. Rice & A. White)*
15:00	*Health Break*
15:15	Finalisation of science advice related to Objectives 1-3 *(Discussion led by J. Rice & A. White)*
17:00	Adjournment of Day 2

Wednesday, March 7, 2012

9:00	Recap of Day 2 and Overview of Day 3 *(J. Rice & A. White)*
9:15	Estimating the volume and diversity of bycatch and discards from Canadian commercial fisheries. *(Presentation by Mike Chadwick; Consultant)*
10:30	*Health Break*
10:45	Estimation of the volume and discards from Canadian commercial fisheries and determine which species would be appropriate for consideration as aquaculture products (Objectives 4 and 5). *(Discussion led by J. Rice & A. White)*
12:30	*Lunch (not provided)*
13:30	Estimation of the volume and discards from Canadian commercial fisheries and determine which species would be appropriate for consideration as aquaculture products (Objectives 4 and 5) – continued... *(Discussion led by J. Rice & A. White)*
14:30	*Health Break*
14:45	Closing Remarks and Discussion of Next Steps *(J. Rice & A. White)*
15:30	Adjournment of Meeting

APPENDIX C: Participant List

Participant	Affiliation
Jake Rice (Co-chair)	DFO Science, NCR
Andrea White (Co-chair)	DFO Science, NCR
Erika Thorleifson (Editor)	DFO Science, NCR (CSAS)
Hugues Benôit	DFO Science, Gulf
David Orr	DFO Science, NL
Kirsten Clark	DFO Science, Maritimes
Heath Stone	DFO Science, Maritimes
Peter Comeau	DFO Science, Maritimes
Diane Archambault	DFO Science, QC
Sylvie Brulotte	DFO Science, QC
Margaret Treble	DFO Science, C&A
Kevin Hedges	DFO Science, C&A
Greg Workman	DFO Science, Pacific
John Martell (Aqua Sci)	DFO Science, NCR
Brent Scott (Aqua Sci)	DFO Science, NCR
Marc Clemens	DFO Program Policy, NCR
Guillaume Côté	DFO Program Policy, NCR
Melissa Evanson	DFO EFM, Pacific
Keith Were	DFO Aquaculture Management, NCR
Scott Wallace	ENGO, David Suzuki Foundation
Susanna Fuller	ENGO, Ecology Action Centre
Tonya Wimmer	ENGO, WWF
Jay Lugar	Industry, Marine Stewardship Council
Sebastian Pardo	External, Simon Fraser University
Alec MacCall	External, NOAA (Pacific)
Mike Chadwick	External, Consultant